



PATENT
Attorney Docket No. 401225

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Application of:

HOSONO et al.

Art Unit: 2822

Application No. 09/871,976

Examiner: T. Tran

Filed: June 4, 2001

For: CARBON BODY PROCESS FOR
PRODUCING THE CARBON BODY,
AND ELECTRIC FIELD EMISSION
ELECTRON SOURCE USING THE
CARBON BODY

**TRANSMITTAL OF
APPELLANTS' APPEAL BRIEF**

U.S. Patent and Trademark Office
Randolph Building
401 Dulany Street, Customer Window, Mail Stop Appeal Brief - Patents
Alexandria, VA 22314

Dear Sir:

In accordance with 37 CFR 41.37, appellants hereby submit Appellants' Brief on Appeal.

The items checked below are appropriate:

1. Status of Appellants

This application is on behalf of ☒ other than a small entity or ☐ a small entity.

2. Fee for Filing Brief on Appeal

Pursuant to 37 CFR 41.20(2), the fee for filing the Brief on Appeal is for: ☒ other than a small entity or ☐ a small entity.

Brief Fee Due \$500.00

3. Oral Hearing

☐ Appellants request an oral hearing in accordance with 37 CFR 41.47.

A separate paper requesting oral hearing is attached.

4. Extension of Time

- ☐ Appellants petition for a one-month extension of time under 37 CFR 1.136, the fee for which is \$ 0.00.
- ☒ Appellants believe that no extension of time is required. However, this conditional petition is being made to provide for the possibility that appellants have inadvertently overlooked the need for a petition and fee for extension of time.

Extension fee due with this request: \$

5. Total Fee Due

The total fee due is:

Brief on Appeal Fee	\$500.00
Request for Oral Hearing	\$ 0.00
Extension Fee (if any)	\$ 0.00

Total Fee Due: \$500.00

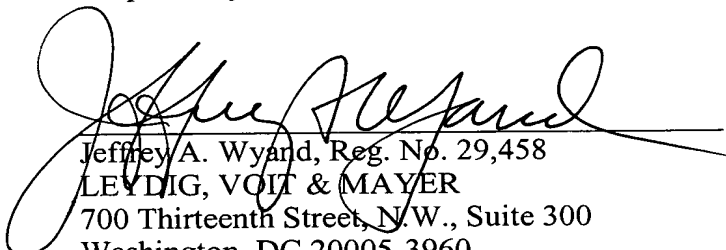
6. Fee Payment

- ☐ Attached is a check in the sum of \$.
- ☒ Charge Account No. 12-1216 the sum of \$500.00. A duplicate of this transmittal is attached.

7. Fee Deficiency.

- ☒ If any additional fee is required in connection with this communication, charge Account No. 12-1216. A duplicate copy of this transmittal is attached.

Respectfully submitted,


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Date: February 4, 2005
JAW/tps

Appeal Brief Transmittal (Revised 1/14/05)



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Dear Sir;

Further to the Notice of Appeal filed December 7, 2004, Appellants now submit their Appeal Brief.

Real Party In Interest

The patent application that is the subject of this appeal is assigned to Mitsubishi Denki Kabushiki Kaisha.

Related Appeals and Interferences

There are no prior or pending appeals, interferences, or judicial proceedings that are related to, directly affect, or may be directly affected by or have a bearing on the Decision in this Appeal.¹

¹ A Petition from a drawing objection was filed and is pending. This Petition is neither an appeal nor an interference and is therefore not cited in this section.

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Status of Claims

This Application was filed with twenty claims. In the course of prosecution, claims 21-28 were added and claims 2-8 and 10-12 were cancelled. Therefore, claims 1, 9, and 13-28 are now pending in this patent application. Of those claims, claims 9, 13, and 14, method claims, have been allowed. Claims 13 and 14 are dependent claims depending from independent claim 9. The remaining pending claims, claims 1 and 15-28, are finally rejected and are the subject of this Appeal. Those claims appear in the Claims Appendix.

Status of Amendments

A Request for Reconsideration, but no amendment was filed on October 26, 2004. An Advisory Action mailed November 12, 2004 indicated that the Request for Reconsideration had been considered and entered in the prosecution file but did not persuade the Examiner to withdraw the final rejection.

Summary of Claimed Subject Matter

The invention concerns a novel carbon structure grown on a substrate and a field emission electrode that incorporates the structure. In order to produce the novel structure, certain deposition conditions must be maintained, as described in the patent application. Those conditions are part of the allowed method claims. As described in the patent application, failure to maintain the required growing conditions can result in the deposition of nanotubes of carbon, a structure distinct from the structure that is described and claimed in the present patent application.

Like many truly novel inventions, defining the structure of the invention disclosed and claimed in this patent application presents substantial difficulties. Thus, the structure claimed is most easily understood, initially, in terms of some of the figures of the patent application. Figures 1 and 2 are line drawings prepared from scanning electron microscope (SEM) photographs. Figure 1 can be considered a plan view of the structure claimed. The view of Figure 1 is perpendicular to a substrate from which the carbon body, indicated by the curved lines, projects. Figure 2 is a side view in which the substrate 1 can be seen along with the interconnected wall 3 that is grown on the substrate and that is substantially perpendicular to the substrate. An important characteristic of this essentially carbon body that is grown on the substrate is that it includes continuously connected intersecting walls 3 that define

apertures or openings. The somewhat random shape of the walls and their interconnections, i.e., intersections, are illustrated in Figures 1 and 2.

Figure 3 is a schematic pictorial diagram, based on the SEM photographs employed to prepare the line drawings of Figures 1 and 2, that aids in understanding the claimed structure. In the embodiment of Figure 3, a substrate 1 has the carbon body 9 projecting from the substrate. The carbon body 9 includes the walls 3 that intersect, for example, at the intersection 3a. Although not part of the independent claims, this carbon body has a hexagonal crystalline structure, like the structure of graphite. Claim 1 can be readily understood as encompassing the structure schematically illustrated in Figure 3 including the substrate 1, the body of carbon 9, disposed on the substrate, and having the continuously connected intersecting walls 3 that are transverse to the substrate.

Claims 21-28 depend from claim 1. Claim 21 adds to claim 1 a description of the openings, like the opening 4 in the embodiment of Figure 3, that are formed by the intersecting walls. As described in the patent application at the beginning of page 22 with respect to the structure shown in Figure 10, in addition to the intersecting walls, depending upon the growth conditions, a continuous film 5 can be deposited along with the intersecting walls. Claim 23 specifies the hexagonal crystalline phase structure of the carbon and that the walls described in claim 24 having a thickness not exceeding 100nm. Of course, since the walls are formed of carbon having a graphite structure, they are electrically conducting so that the intersections result in electrical continuity throughout the structure as specified in claim 25. The substrate on which the carbon walls are grown may be a number of different materials, including glass, as specified in claim 26. The openings 4 as shown in Figures 1-3 of the patent application may be aligned along a common axis as in claim 27. Those figures indicate that the axis is generally perpendicular to the substrate as specified in claim 28.

The other pending independent claim is claim 15, a claim directed to a field emission electron source. As well known to those of skill in the art, a field emission cathode emits electrons in response to a high intensity electric field, usually without being elevated in temperature. Fundamentally, the structure of the claimed field emission electron source is the same as the structure described in claim 1. Thus, the same disclosure in the patent application that supports claim 1 likewise supports claim 15. Field emission sources and their characteristics are described in the patent application with regard to Figures 12-24. Those figures and the corresponding description support claims 16-20. The limitation of claim 16 is substantially similar to the limitation of claim 21. Claim 17 adds to the field emission electron source of claim 15 an electron extraction electrode that surrounds the

carbon body with the intersecting walls transverse to the substrate. A structure within the scope of claim 17 is shown in a schematic side view in Figure 17 of the patent application.

Claim 18 is directed to a different arrangement of a field emission electron source including the carbon body. The structure of claim 18, which is supported by the embodiment of Figure 19, includes a cathode electrode and a backside electrode. These electrodes are geometrically arranged with respect to each other as described in the claim and as shown in the encompassed embodiment. Claims 19 and 20 both depend from claim 18 and describe other arrangements of the cathode and backside electrodes that are supported in the patent application with respect to the embodiments of Figures 21 and 23, respectively.

Grounds of Rejection to be reviewed on Appeal

All of the finally rejected claims, claims 1 and 15-28, have been rejected as anticipated by Nakamoto (U.S. Patent 6,097,138). This single ground of rejection is the only pending rejection and the only issue to be reviewed in this Appeal.

Argument

It is almost too elementary to state that anticipation requires that a prior art publication disclose every element of a claimed invention. Nakamoto fails that difficult test with respect to claims 1 and 15-28.

Nakamoto fundamentally describes two different field emission cathode structures, both formed from carbon nanotubes. Distinctly different fabrication techniques, leading to different kinds of structures, are employed to fabricate the field emission structure of Figures 1A and 1B of Nakamoto as compared to the structures shown in Nakamoto's Figures 3A and 3B. However, the Examiner has improperly mixed together these two different structures, particularly in the remarks accompanying the Advisory Action.

As described in columns 4-6 of Nakamoto, the structure shown in Figures 1A and 1B is prepared by first growing carbon nanotubes on a substrate and then severing those carbon nanotubes from that precursor substrate. As described at column 6, lines 9-20 of Nakamoto, those severed carbon nanotubes are mixed with a bonding agent and glued to the substrate 12 of Figure 1A. The carbon nanotubes are oriented randomly with respect to the substrate. Some parts of the bonded structure are removed, using masking and etching techniques, to produce the structure shown in Figure 1B of Nakamoto.

By contrast with the method of manufacturing the field emission cathode of Figures 1A and 1B of Nakamoto, in the structure shown in Figures 3A and 3B of Nakamoto, the carbon nanotubes are formed directly on the substrate. The process conditions employed to produce this structure are entirely different from those of depositing the carbon nanotubes used in the former embodiment as described in column 7, lines 17-45 of Nakamoto. In the second embodiment, the carbon nanotubes 16 are directly deposited on the carbon interconnecting layer 28.

There is an important difference between the two structures that are produced by Nakamoto, as shown schematically in Figures 1A and 3A of Nakamoto. In the latter structure, the carbon nanotubes are isolated from each other physically. Therefore, that structure, lacking even contacting walls, cannot anticipate any pending claim. This lack of anticipation was impliedly conceded by the Examiner because reliance was placed solely on Figures 1A and 1B of Nakamoto as anticipating independent claims 1 and 15.

It is apparent upon studying Figures 1A and 1B of Nakamoto and the associated description, that the structure depicted there does not include a carbon body having a plurality of continuously connected intersecting walls transverse to the substrate. To the extent there is any resemblance between the structure claimed in the claims on appeal and Figure 1B of Nakamoto, even Nakamoto recognizes that Figures 1A and 1B are schematic, not pictorial, in nature. See column 5, lines 1-7.

“Each emitter 14 is made up of a plurality of carbon nanotubes 16 basically constituted by an array of 6-membered rings of carbon. As shown in FIGS. 1A and 1B, the carbon nanotubes 16 normally exist like fallen trees overlapping each other on the support substrate 12. However, for the sake of simplicity, the carbon nanotubes 16 rise nearly vertically in the following drawings.”

This description from Nakamoto itself, particularly taken in combination with the description of how the carbon nanotubes, mixed with a bonding agent, are applied to the substrate 12, demonstrates that no wall structure, like the continuously connected intersecting carbon walls transverse to the substrate of the claims, is ever formed or described in Nakamoto.

First, in Nakamoto, there is the bonding agent which presumably is interposed between respective nanotubes as well as between the nanotubes and the substrate 12. Thus, there can be no body *essentially of carbon* that forms continuously connected intersecting walls. Any walls in Nakamoto are a mixture of carbon nanotubes and a bonding agent.

Second, even if some of the nanotubes in Nakamoto should contact each other within the matrix of the bonding agent, there is no formation of continuously connected intersecting walls. As shown in the figures of the present patent application, the intersection of the walls does not mean that the walls merely contact each other in a tangential way. Only such tangential contact could occur for carbon nanotubes in the structure shown in Figure 1A of Nakamoto. In the invention, the walls of the carbon body are continuous and grow together, a description made clear by the word “intersecting” in the claims. Intersect and intersection mean, according to the dictionary, “to cut across or through”, and “a place where things intersect, esp. a place where two or more roads cross.” The potential contact between outer surfaces of carbon nanotubes in a bonding agent matrix cannot fit within the plain meaning of the word “intersecting” in the claims. The claimed structure is clearly distinct from and cannot be anticipated by Nakamoto.

Third, while some of the nanotubes are shown as perpendicular to the substrate 12 in Figure 1A in Nakamoto, even Nakamoto admits that this illustration is schematic and not realistic. Therefore, the further limitation of claims 1 and 15 regarding the transverse orientation of the continuously connected intersecting walls of the carbon body with respect to the substrate is not met by the disclosure of Nakamoto.

Fourth, the description in Nakamoto of the structure of Figures 1A and 1B as a “fallen tree” structure makes clear that no walls of carbon can be present in the structure illustrated by Figure 1A of Nakamoto. In the final rejection, the Examiner asserted that “the plurality of overlapped carbon nanotubes 16 establish the ‘continuously connected intersecting walls transverse [to] the substrate’” of claims 1 and 15. (Office Action mailed August 10, 2004, at page 3.) This assertion is not supported by any description in Nakamoto and is contrary to the common meaning of the word “wall”, the meaning employed in claims 1 and 15.

Nakamoto’s unusual and descriptive term, “fallen tree” structure, is contrary to the connotation of a wall. Rather, that phrase, while uncommon, suggests the kind of structure one might find in an old forest in which many ancient trees have randomly fallen, perhaps establishing a labyrinth or barriers to walking, but not a wall. In the Request for Reconsideration, Applicants supplied the dictionary definition of the common term “wall”. Although that term is used in numerous different contexts, every context means a continuous structure. For example, with regard to construction, a wall is an upright structure that encloses, divides, or protects an area, “esp. a vertical construction forming an inner partition or exterior siding of a building.” American Heritage Dictionary (1985). Further consistent definitions of the term “wall” were supplied at page 4 of the Request for Reconsideration. Moreover, the word “wall” is so common in usage and meaning that it seems unnecessary to

extend the discussion because no one would ever consider a “fallen tree” structure to be the same as, much less equivalent to, a wall.

Because of any of these four basic differences between Nakamoto and the claimed invention, the rejection of claims 1 and 15 as anticipated by Nakamoto must be reversed. Upon the reversal of the rejection of those two independent claims, the rejection for anticipation of the remaining pending claims, claims 16-28, must also be reversed because those claims all depend directly or indirectly either from claim 1 or from claim 15.

Should the Board conclude that Nakamoto anticipates claims 1 and 15, then additional and separate attention must be given to each of claims 18, 19, and 20, claims describing specific field emission electrode structures. The Examiner asserts that each of these specific structures is anticipated by the field emission structure shown in Figure 9C of Nakamoto. In fact, there are significant differences between what is described in each of these claims and what is shown in Figure 9C of Nakamoto. Claims 19 and 20 respectively depend from claim 18 so that if claim 18 is not anticipated by Nakamoto, neither of claims 19 and 20 can be anticipated.

As previously described, the field emission electron source according to claim 18 includes, in addition to the carbon body extensively described above, two electrodes. A cathode electrode supplies electrons to the carbon body. A backside extraction electrode is located at a rear side of that body of carbon, not at the front side from which electrons are emitted. The only electrode at the rear side of electron emitting carbon nanotube 16 shown in Figure 9C of Nakamoto is the cathode electrode 28. The extraction electrode 54, identified by the Examiner in rejecting claim 17, is clearly at the front side of the emitter. There is no possibility that the structure shown in Figure 9C of Nakamoto could include every element of the structure of claim 18 because Figure 9C includes no backside extraction electrode. Therefore, the rejection of that claim as well as claims 19 and 20 as anticipated must be reversed.

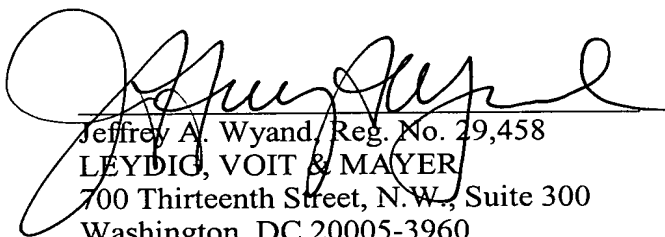
In the structure of claim 19, in addition to including the elements of claim 18, the cathode electrode is located only at a periphery of the carbon body. Clearly, in Figure 9C of Nakamoto, the cathode electrode 28 is located directly opposite every part of the carbon nanotube 16. Thus, that structure of Nakamoto cannot anticipate claim 19.

In the electric field emission electron source of claim 20, the cathode electrode is positioned outside the backside extraction electrode and not overlapping the backside extraction electrode, when viewed in a direction perpendicular to the substrate. This claim cannot be anticipated by the structure in Figure 9C of Nakamoto because in Figure 9C of Nakamoto there is no backside electrode. Even if, for purposes of argument, the front side

electrode 54 were considered the backside extraction electrode, that electrode is not located outside the cathode electrode 28, but overlaps that electrode 28 when viewed perpendicular to the substrate 12. Clearly, independent of the failure of Nakamoto to anticipate claim 18, Nakamoto fails to anticipate claim 20.

The rejection of all claims as anticipated by Nakamoto must be reversed because Appellants have identified four fundamental elements of the two pending independent claims, claims 1 and 15, that are not described by Nakamoto. Nakamoto fails to describe a body consisting essentially of carbon, such a body forming walls, such a structure including intersecting walls, or such a structure with such walls transverse to a substrate. Because of any and all of these differences, the rejection of all of claims 1 and 15-28 must be reversed. Further, claims 18-20 include additional distinguishing features separately requiring the reversal of the rejection of those claims.

Respectfully submitted,



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Date:

February 4, 2005

JAW/tps

Appeal_Brief (Revised 09/15/04)

Claims Appendix

The following claims are finally rejected and on appeal.

1. A structure including a carbon body comprising:
a substrate; and
a body consisting essentially of carbon and disposed on the substrate, the body consisting essentially of carbon having a plurality of continuously connected intersecting walls transverse to the substrate.
15. An electric field emission electron source including:
a substrate; and
a body consisting essentially of carbon and disposed on the substrate as an electron emitting member for emitting electrons, the body consisting essentially of carbon having a plurality of continuously connected intersecting walls transverse to the substrate.
16. The electric field emission electron source according to claim 15, wherein the continuously connected intersecting walls define perimeters of openings that are located between intersections of the continuously connected intersecting walls.
17. The electric field emission electron source according to claim 15, including a cathode electrode for supplying electrons to the body consisting essentially of carbon, and an extraction electrode for generating an electric field for inducing emission of electrons from the body consisting essentially of carbon, wherein the body consisting essentially of carbon is positioned opposite the cathode electrode, contacting the cathode electrode, and the extraction electrode is positioned surrounding the body consisting essentially of carbon without overlapping the body consisting essentially of carbon, when viewed in a direction transverse to the substrate.
18. The electric field emission electron source according to claim 15, including a cathode electrode for supplying electrons to the body consisting essentially of carbon, and
a backside extraction electrode, positioned at a rear side of the body of carbon, for generating, from the rear side of the body consisting essentially of carbon, an electric field for inducing emission of electrons from a front side of the body consisting essentially of carbon,

the front side of the body consisting essentially of carbon being opposite the rear side of the body consisting essentially of carbon, wherein

the cathode electrode is positioned opposite the backside extraction electrode,
and

the body consisting essentially of carbon is positioned opposite the cathode electrode, contacting the cathode electrode.

19. The electric field emission electron source according to claim 18, wherein the cathode electrode is located only at a periphery of the body consisting essentially of carbon.

20. The electric field emission electron source according to claim 18, wherein the cathode electrode is positioned outside the backside extraction electrode and not overlapping the backside extraction electrode, when viewed in a direction perpendicular to the substrate.

21. The structure according to claim 1, wherein the continuously connected intersecting walls define perimeters of openings that are located between intersections of the continuously connected intersecting walls.

22. The structure according to claim 21 including a continuous film in the openings at the substrate.

23. The structure according to claim 1, wherein the body consisting essentially of carbon includes a hexagonal crystalline phase.

24. The structure according to claim 1, wherein the walls have an average thickness on the substrate not exceeding 100 nm.

25. The structure according to claim 1, wherein the walls are continuously connected electrically.

26. The structure according to claim 1, wherein the substrate is glass.

27. The structure according to claim 21, wherein the openings are aligned along a common direction.

28. The structure according to claim 27, wherein the direction is transverse to the substrate.

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Evidence Appendix

No evidence was submitted in the prosecution of the patent application.

In re Appln. of HOSONO et al.
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Related Proceedings Appendix

There are no related proceedings.